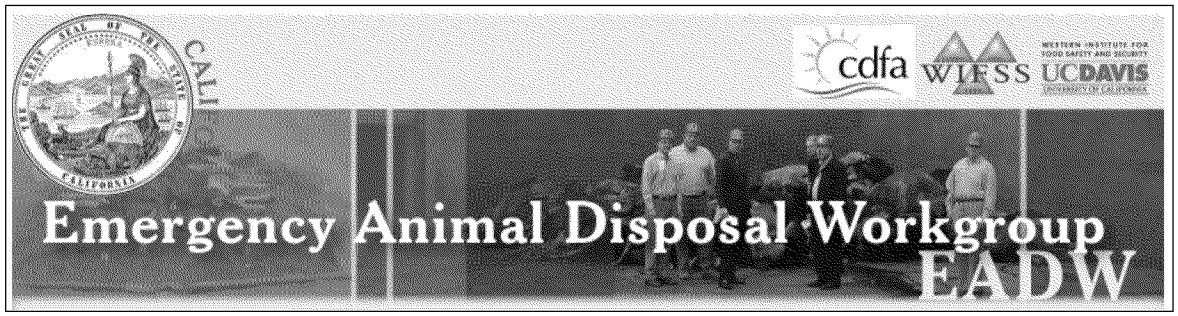


California Environmental Protection Agency

cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

CHALLENGES TO DISPOSAL OF LIVESTOCK & POULTRY MORTALITIES AND ANIMAL BY-PRODUCTS IN CALIFORNIA

California Emergency Animal Disposal Workgroup
July 2011

Table of Contents

Section I. Executive Summary

California is home to thriving and diverse food-animal industries including dairy, beef, poultry, egg, and seafood production. The State's dairies produce over 20% of the U.S milk supply, and California has been the number one dairy state since 1993. California is second only to Texas in production of sheep and is ranked fifth in poultry production. The animal agriculture industry contributes enormously to the State's economy with current estimates placing a combined value of agricultural products at $12.1 billion in 2008 (value of animals and products only). Most of these industries are located in the Central Valley region, but there are also dairies along the north coast, dairy and poultry operations in the Sonoma/ Marin area, dairies in Glenn and Tehama counties, dairy and poultry operations south of the Tehachapi mountain range, and beef and sheep production in areas throughout the state. Integral to the health of these industries is an efficient and sustainable infrastructure for disposing or recycling of animal mortalities and inedible by-products. Disposal and recycling practices must be protective of public health, animal health and the environment, be suitable for use during normal operating conditions and be available during emergencies such as contagious disease outbreak, toxin-related deaths, and surges in mortalities due to natural disasters such as floods, fires, earthquakes, and extreme weather.

Rendering is the preferred animal mortality management option in California, but rendering capacity is limited. There are only about half a dozen in California that accept animal carcasses: four in the Central Valley, two in southern California, and one along the Central Coast. In the summer of 2006, the Central Valley region experienced elevated heat and humidity that resulted in a surge in animal mortalities. Under normal circumstances, this surge in mortalities would have been handled by the region's rendering plants but unfortunately a rendering plant in Stanislaus County had closed and its in-flow had been shifted to other plants. The resulting reduction in regional processing capacity coupled with logistical and operational issues at other regional rendering plants, resulted in an accumulation of mortalities on the farm, at collection sites, and at rendering plants. The industry and regulators moved quickly to identify alternative disposal options, but problems identified during the event indicated that actions were needed to increase mortality management options.

In March 2007, the California Conference of Directors of Environmental Health and the California Conference of Local Health Officers communicated to the California Department of Food and Agriculture (CDFA) and the California Environmental Protection Agency (Cal/EPA) that "Considerations of public health and environmental protection make it imperative that the state develops a contingency plan for the disposal of large numbers of animal carcasses in an emergency." Representatives of the conferences and of the state agencies committed to working with stakeholders to meet this objective.

CDFA and Cal/EPA have a longstanding working relationship regarding issues surrounding animal carcass disposal during animal health emergencies and natural disasters, but the request provided them the opportunity to engage additional stakeholders. CDFA and Cal/EPA were then able to form and co-chair an ad hoc group to study the challenges of emergency animal carcass disposal and to develop potential solutions. The two agencies formed the Emergency Animal Disposal Workgroup (Workgroup) and engaged the University of California's Western Institute for Food Safety and Security to facilitate the effort. The Workgroup first met on July 20th, 2007, and continues to meet regularly. The importance of the animal mortality issue to a wide variety of public and private sectors is exemplified by the fact that as of December 2010 the Workgroup has more than 120 members representing local, regional, state,

and federal levels of the animal industries, government, and the rendering industry, and waste management industries.

The Workgroup prepared this document to describe the current status of California's animal mortality management system and the challenges it faces during emergencies. Subsequent activities of the Workgroup will identify potential options to address those challenges. Specific issues that the Workgroup identified are: 1) growth and redistribution of animal populations without a corresponding growth and redistribution of rendering, 2) limited legal options for routine mortality disposal, and 3) an inefficient process for handling surges in animal mortalities.

The Workgroup recognizes that California's rendering plants are critical health and safety infrastructure for the State. Rendering is the most efficient and cost-effective mortality management tool for controlling many human and animal disease pathogens, protecting our groundwater and air resources, and reducing greenhouse gas emissions. Every year California renderers recycle approximately 2.4 billion pounds of perishable material generated by farms, livestock and poultry operations, food processors, supermarkets, and restaurants. However, the economic viability of rendering plants is being challenged – especially those that accept cattle mortalities. A primary current challenge is the cost for complying with federal feed safety rules related to Bovine Spongiform Encephalopathy ("Mad Cow Disease") and cost for complying with more rigorous environmental regulations. Also contributing to the challenges of operating, expanding, and/or building new rendering plants in California is the ongoing urban encroachment into the once rural locations where rendering plants were typically built.

Historically, laws and regulations that addressed mortality management in California were focused on preventing diversion of meat not fit for human consumption back into the human food chain and protecting other animals from diseases[1]. In addition, in the 1990s concerns regarding effectiveness of the compost process in reducing pathogens lead to a prohibition on composting of mammalian tissue[2]. Increasing concerns regarding air pollution in the state has also affected mortality disposal practices. More recent efforts to address threats to surface water and groundwater have resulted in the major Regional Water Quality Control Board within California enforcing regulations that prohibit on-farm disposal of waste, including animal mortalities, unless specifically allowed by waste discharge requirements.

The Workgroup determined that among the issues that needed to be addressed included at least temporary "quick fix" solutions before the occurrence of another emergency mortality crisis. In addition mortality disposal stakeholders needed to be identified and an efficient communication between them established. Appropriate local and state-wide emergency procedures needed to be developed or clarified. The Workgroup also identified needed changes in the Food and Agricultural Code (FAC) to authorize access to alternative disposal sites such as landfills during emergencies and changes in state regulations necessary to allow for research on alternative emergency disposal methods. Identification of the locations and conditions for disposal at the alternative sites was also needed.

Some changes in FAC have been made through the efforts of the Workgroup. Research on alternative mortality management practices is now possible and some alternative disposal options have been identified that have potential applicability during future emergencies. In addition, communications links among stakeholders has improved and there is better understanding of emergency carcass disposal procedures across the board. The workgroup recognizes that additional solutions are likely to be needed to address the changing dynamics of

[1] Food and Agricultural Code [FAC] Section 19348
[2] California Code of Regulations (CCR), Title 14, Section 17855.2

livestock production, protection of the environment, and protection of human health. Potential long-term solutions will be addressed in subsequent activities of the Workgroup.

Section II. Introduction

The purpose of this document is to describe current animal carcass disposal practices in California and significant challenges related to those practices. This document includes a history of events leading to the formation of the Emergency Animal Disposal Workgroup (EADW, an ongoing collaborative effort) and describes the EADW's role in animal disposal planning. Specifically this document:

- describes livestock and poultry production systems in California, the current carcass disposal infrastructure, and the various disposal methods used;
- identifies and discusses the laws and regulations affecting animal disposal with emphasis on how the concept of "emergency disposal" is applied; and
- discusses utilization of resources for handling surges in animal mortalities.

After finishing this document, the reader will have an understanding of both the State's animal carcass disposal system and the challenges currently facing it.

The EADW was formed because regulatory agencies, academia, rendering companies, and the livestock and poultry industries recognized that unexpected events (animal health emergencies, extreme weather conditions, or service disruptions in the rendering industry) could and have challenged the surge capacity of existing authorized disposal methods and systems. These stakeholders recognized that to avoid unnecessary disposal costs, address public concerns, and prevent adverse environmental impacts, the identified deficiencies needed to be addressed. Following the California summer heat and humidity event of 2006, the California Conference of Directors of Environmental Health and the California Conference of Local Health Officers expressed their concerns by letter to the California Department of Food and Agriculture (CDFA) and the California Environmental Protection Agency (Cal/EPA). CDFA and Cal/EPA used this opportunity and offer for assistance to develop and co-chair an ad hoc group to study the problem and develop potential solutions. The California Integrated Waste Management Board (CIWMB) was selected as lead agency for Cal/EPA, and in conjunction with CDFA engaged the University of California's Western Institute for Food Safety and Security (WIFSS) to facilitate the effort. The first organizational meeting for EADW was held July 20, 2007.

The EADW has determined that it needs to:

- Identify and characterize the State's current capacity to handle surges in animal mortalities during animal disease emergencies;
- Determine what current disposal resources exist in the State
- Identify short term solutions to provide disposal options while long-terms solutions are under development; and,

- Identify best long-term solutions to assure there will be sufficient mortality management capacity over time.

This document addresses the first two of these objectives. Subsequent activities will focus on short-term and long-term options to address disposal challenges.

Section III: Background

A number of bell-weather events and circumstances regarding disposal of animal mortalities predating the formation of the EADW led to a general realization that there was a need to understand, describe, and identify challenges in California's animal carcass disposal capacity. Those events included the disposal challenges faced during the British Bovine Spongiform Encephalopathy (BSE) outbreak in the 1980s and 1990s and the British Foot and Mouth Disease crisis in 2000-2001. Recognizing the need to develop emergency animal disposal guidelines, Cal/EPA in cooperation with CDFA and the California Department of Health Services (now the California Department of Public Health), developed the document "*CAL/EPA Emergency Animal Disease: Regulatory Guidance for Disposal and Decontamination*" that was released in October 2004. Activities leading to the development of that document are discussed below.

Spring 2002. CDFA convened a meeting with various stakeholders to discuss concerns that had been expressed regarding limited disposal options for animal mortalities under both routine and catastrophic conditions. Many of the concerns were related to loss of dead animal hauling services along the North Coast and the limited dead animal hauling and disposal options in the Imperial Valley. The meeting did not result in a consensus regarding the extent of the problem or the stakeholder actions that could be implemented.

Late 2002 and early 2003. CDFA and the United States Department of Agriculture, Animal and Plant Health Inspection Service-Veterinary Services (USDA-VS) led a response to eradicate Exotic Newcastle Virus diagnosed in poultry in Southern California. The event necessitated off-site disposal of birds because on-farm disposal was inadequate. CDFA and USDA-VS opted to use local landfills for disposal. Implementing this option required obtaining "contagious disease authority" from CDFA and USDA-VS as well as technical assistance and consultation from the CIWMB, the Central Valley Regional Water Quality Control Board (RWB), the Santa Ana Regional Water Quality Control Board and other agencies with related expertise and oversight of transportation and disposal at solid waste facilities. The California Governor's Office of Emergency Services, now a part of the California Emergency Management Agency (Cal-EMA), helped to facilitate State agency participation in resolving the enormous challenge posed the carcass disposal caused by an Exotic Newcastle Virus outbreak in Southern California.

Spring and Summer 2006. Imperial County livestock producers expressed their concern again regarding the lack of local disposal options. This ultimately led to a change in California law allowing for movement of animal material across state lines if the recipient state is willing to accept the material[3].

Animal Population Growth

The redistribution and expansion of the dairy and poultry industries in the south San Joaquin Valley (SJV), starting in the 1990s and continuing into this decade, occurred without a timely expansion in regional rendering capacity. The SJV has been a popular relocation site for dairymen leaving southern California. From 2001 to 2008 the number of cows and heifers that calved in the valley from Kern to San Joaquin counties increased 38% from 1,172,721 to 1,614,151. While it would seem logical to simply discuss increasing regional rendering capacity to match increases in animal populations, there are significant logistical, economic and regulatory hurdles in such endeavors. A rendering company must balance the cost of processing mortalities verses the potential return of the end product, e.g. meat and bone meal and tallow. Consideration must also be given to servicing other inputs such as slaughterhouse offal and inedible kitchen grease which often yield higher value end-products at a lower cost. The region's rendering service capacity was further stressed due to the fact that a major rendering plant serving the Central Valley closed in 2005. While other renderers adapted to absorb the plant's customers, ultimately expansion at those plants would be necessary to handle the additional incoming material. The speed at which local expansion of those plants could occur is dictated by local planning officials and the process of permitting approval is typically slow at best.

Regulatory issues, related primarily to BSE prevention and environmental protection, have also dramatically increased operating costs for rendering plant operators and profoundly limited their marketing options, driving down the price for their products. This "perfect storm" of events has threatened the economic viability of the rendering industry in this and other states and has raised concerns about the long-term viability of rendering availability for cattle material in California. This decline of renderer profitability is best exemplified by the fact that within living memory renderers initially paid farmers for carcasses, which evolved to picking up the carcasses for free to the current situation where producers typically are charged approximately $100 to $200 dollars per carcass in order for a rendering company to operate profitably.

Another relevant factor is that as the number of dairy cows has increased in California so has there been an increase cull cow numbers, creating more demand for meat processing, a process which has by-products which utilize rendering capacity. The Monthly Livestock Review estimated that the number of cull cows processed at the two meat processing plants in the State increased from 1,019,800 head in 1998 to 1,568,500 head in 2008 and increase of 54%. Rendering plants process animal by-product (offal) from meat processing plants and this material competes for the available rendering capacity with dead animals. For instance in 2007-2008, the state's rendering industry processed just under 2.5 billion pounds of material. While this total includes 252 million pounds of animal carcasses, animal and poultry carcasses competed with more than twice that volume of offal from slaughterhouse and custom-kill operations (544 million pounds). (Pacific Coast Rendering Association Table 3).

[3] Food and Agricultural Code [FAC] Section 19348

Nature of the Rendering Industry

Rendering technology recycles by-products from animal agriculture into marketable products. It protects animal and public health, protects air and water quality, and minimizes impacts on solid waste management systems by annually recycling over 1.9 billion pounds of livestock and poultry materials.

Because of the nature of the industry, rendering plants have traditionally been located away from residential areas. However, urban encroachment into the once rural locations where rendering plants were built has limited opportunities for expansion of existing facilities. Also, complaints from new neighbors have sometimes resulted in new regulatory agency requirements that have made expansion an even greater challenge.

Rendering is a for-profit commercial enterprise and the quality of the material being processed, the variable costs of processing and market conditions affect the volume and type of material processed. Some materials, such as poultry feathers and wool from sheep, are difficult to process and have negative effects on the rendering system and/or the quality of the end products. Hides from badly decomposed carcasses cannot be recovered, and thus also have limited or no value. Also, carcasses contaminated with chemicals that are not acceptable in end products must be processed separately from other material. For these reasons rendering plants frequently have limitations and/or variable fee schedules for pick-up of mortalities, a situation that causes some animal producers to look for other disposal options.

Historically, rendering has not been utilized as the sole method of disposal for animal mortality. However, because of concerns about the spread of contagious diseases and the diversion of tissue from animal carcasses to food for human consumption, FAC Section 19348 limits off-site disposal of animal mortality and identifies rendering as the primary disposal option. While on-farm burial of a producer's own animals is not prohibited by FAC Section 19348, burial or other on-farm disposal is frequently regulated by regulatory authorities in order to protect water resources and air quality. This has resulted in an increased reliance on rendering, an industry which is highly regulated and permitted by air and water regulatory agencies. During an emergency event, without waiver from an emergency declaration, renderers may be limited in their capacity to accept and process mortalities due to limitations in their air and water permits which stipulate the conditions in which the facility can operate, e.g. days, times, total hours, etc.

Regulatory Agencies and Authority Related to Mortality Disposal

Water Quality. The Regional Water Quality Control Boards (RWBs) are responsible for the protection of water quality in the State. The Central Valley RWB oversees protection of water quality in the Central Valley, including the San Joaquin Valley, in which reside over 85% of the State's dairy cows. Concerns regarding the increased concentration of dairy animals in the SJV and the potential for impacts to water quality led to development of a general Waste Discharge Requirements (WDR) order for dairies in May 2007. General WDR Order No. R5-2007-0035

prohibits on-farm disposal of dairy carcasses including burning, burial and composting. Each dairy operator is expected to send mortalities to rendering.

Air Quality. The Air Quality Control Districts are public health agencies mandated to improve the health and quality of life for residents by meeting health-based state and federal ambient air quality standards. Some 70% of the State's dairy cows are located in the San Joaquin Valley Air Pollution Control District. Although this agency has no current rules directly associated with mortality management on the farm (rendering plants have long been subject to District regulation), the District is in extreme non-attainment status for the Federal 8 hour ozone standard and remains out of compliance with State Particulate Matter Standards during parts of the year. However, other Rules within the District may apply to current or future mortality management. Any management practices causing health risk or odor nuisance may be subject to District Rule 4102. Any new or modified practices associated with mortality management may require a District permit and may be subject to New Source Review (Rule 2201). Although incineration of mortality is technically possible, the incinerator would also need to comply with District Rule 4302. Other areas of the State are governed by different Air Quality Control Districts, which may have similar rules.

Public and Animal Health. An additional restriction affecting disposal options is the ban on composting mammalian flesh cited in the California Code of Regulations (CCR), Title 14, Natural Resources, Division 7, Chapter 3.1, Article 2, Section 17855.2. This prohibition was implemented in the 1990's following concerns raised related to whether or not composting destroyed the BSE prion, the infectious protein which causes BSE. In addition, concerns have been expressed that there are limited data regarding pathogen reduction capabilities of real world composting of carcasses for a number of pathogens. EADW and other organizations have and are performing research in an effort to fill the knowledge gap related to bacterial pathogens but pathogen reduction studies using prions is typically not allowed outside of a bio-secure laboratory.

Solid Waste Management and Landfills. FAC Section 19348 has in the past limited livestock and poultry off-site disposal options to rendering, collection centers for rendering, approved diagnostic laboratories, the nearest crematorium, or out of state disposal with approval of the recipient state. The primary goal of the law is protection of animal health, human health, and the environment by allowing recycling of animal protein and fat while preventing or controlling the spread of contagious diseases. However, the Exotic Newcastle Virus disease event of 2002-2003 illustrated the need for redirection of carcasses to other means of disposal under special circumstances. Iterations of changes to FAC 19348 since 2000 have given the State Veterinarian the authority to allow off-site disposal by means other than rendering in emergencies. [4] The most recent modification to FAC 19348 also introduced a permit system under the authority of the Secretary of Agriculture to permit disposal in landfills during declared emergencies or when a licensed renderer certifies that it cannot process a carcass. The practical application of this provision has yet to be realized, both because of an absence of a logistical mechanism by which a carcass can be documented as refused by a rendering

company or a mechanism by which "certified carcasses" can be transported to landfills. In addition one potential obstacle to having "refused" carcasses disposed of in landfills is the limited number of landfills permitted to routinely accept livestock and poultry carcasses.

Aside from the restrictions imposed by FAC Section 19348, solid waste permits for many landfills in the State do not authorize receipt of animals, especially large animals. Landfills that are not authorized to receive animals require a waiver via an emergency declaration to allow the facility to accept the material. Even if permitted to accept animal carcasses, a landfill may still require an emergency declaration if the animal materials cause them to exceed volume limits or forces them to operate outside of specified operating hours[4]. Ultimately the decision to accept or reject animal mortalities is at the discretion of the landfill operator. The issue of regulatory aspects of carcass disposal in landfills is covered in more detail in Section VII.

Summer of 2006 Heat Event

The critical nature of a healthy and functioning rendering infrastructure – especially its ability to deal with surges in animal mortality during emergencies – was demonstrated in the summer of 2006. In June and July of that year California experienced an unusual, prolonged heat wave. During one 30 day period the Southern San Joaquin Valley (SJV) counties experienced 28 days with temperatures at or exceeding 95° F and 20 days of 100° F or greater. Importantly there was also minimal cooling at night. Prolonged exposure to heat resulted in increased mortality rates at dairies and poultry facilities throughout the valley. Under normal circumstances, this surge in mortalities could potentially been disposed of by the existing rendering infrastructure. However, a rendering plant in Stanislaus County that had processed livestock mortalities closed in 2005, reducing the region's rendering capacity. Further aggravating the situation, a critical SJV rendering facility experienced mechanical difficulties coinciding with the heat wave. Extensive delays in mortality management occurred throughout the disposal chain, from on-farm pickup, to storage and processing. The intense heat and delays in carcass retrieval resulted in advanced decomposition in many carcasses, further slowing processing operations. Mortalities accumulated at many dairies and poultry facilities throughout the Central Valley. The magnitude of the problem was first recognized in Fresno and Kings Counties when large numbers of unprocessed carcasses became obvious at the collection centers and rendering plants. Not appreciated until later however was the impact on neighboring counties in the Central Valley. Since only several rendering plants serve the entire region, an interruption in service in one plant or plants can ripple across into other counties, becoming a regional problem. Subsequent to the heat event producers were surveyed by Agricultural Commissioners' staff in order to estimate animal losses for disaster relief. These data suggest that in eight Central Valley counties some 20,000 cows, 20,000 calves, and more than 1,000,000 chickens and turkeys died in excess of losses experienced during the same months in typical years. With rendering capacity stretched to its limit, eight counties were forced to enact emergency declarations allowing alternative disposal methods to be employed. The local emergency declaration triggered the availability of emergency waivers authorizing several counties to utilize solid waste

[4] 14 CCR 17210-17210.9

landfills to dispose of the mortalities and some other counties to allow on-farm composting or burial.

County emergency managers, agricultural commissioners, environmental health officers, and CDFA and CIWMB staff assessed the situation during conference calls facilitated by the California Office of Emergency Services (now Cal-EMA). During the phone calls it became apparent that:

- The disposal problem was extensive and extended throughout the southern Central Valley ;
- Cal/EPA had an emergency animal disposal (EAD) plan which had been developed for just such an event; and,
- Local emergency proclamations were needed to provide other avenues for disposal.

Using the Cal/EPA EAD plan that suggested a hierarchy of disposal options, the counties were able to provide guidance for disposal to facility owners and managers. Various jurisdictions applied the EPA guidance with consideration to the local conditions in determining which disposal options could be used. Local emergency proclamations allowed the use of options such as composting and burial with the understanding that environmental impacts would be re-assessed later. There was discussion of a regional or State-wide emergency proclamation; however, that did not occur. Rendering services and landfills within the affected counties were able to manage the mortality removed from the animal facilities. However, use of similar services outside of declared areas was hampered because they had to adhere to "non-emergency" permitting constraints.

While a tragic event from and animal health standpoint, the heat event in the summer of 2006 did provide some important lessons.

- A number of public and private managers gained first-hand experience with emergency animal disposal challenges and application of the emergency management system. They learned how and when to use proclamations, who represented technical resources in such emergencies and what limitations are associated with various disposal options.
- Some landfill operators developed expertise in efficiently handling carcasses at a landfill. Cattle carcasses which are partially composted are reported to be far easier to manipulate then when carcasses which had simply been left to decompose in the heat. Similarly chicken carcass "slurry" proved difficult to effectively move with a landfill's available equipment. The addition of an absorbent-bulking material such as almond hulls, greatly improved this situation.
- It became clear that limiting disposal options to only local resources hindered the effectiveness of the response, since existing disposal resources outside the declared areas could not be leveraged. This suggests that State agencies need to provide situational awareness to Cal-EMA during an emergency. For instance, a Governor's Proclamation might be recommended to allow use of regional resources to address a local emergency.

- Effective and prompt communication is critical, beginning with quickly identifying whom to contact.
- Officials who regulate routine animal disposal developed better understanding of emergency disposal practices. Subsequent to 2006, at least two counties (Kings and Tulare) began requiring new and expanding dairies to provide proof of adequate disposal services.
- Kings County also developed a plan specific to animal disposal, and Stanislaus and Fresno Counties developed "all-hazard" agricultural plans that include carcass disposal. Templates of these plans are available for use by other counties.
- Two rendering facilities have made upgrades at their plants.
- FAC Section 19348 has been amended to facilitate the use of landfills under specific conditions.
- FAC Section 19348.1 has been added to allow temporary research projects assessing alternative methods for animal tissue disposal.
- 14 CCR 17855.2 was amended to allow carcass compost research.
- Based on experiences during the event, the Emergency Animal Disposal Workgroup (EADW) was formed to assess emergency animal disposal challenges in California and to identify potential improvements in disposal practices.
    - Research was started by the Workgroup to evaluate composting of mammalian tissue for some parameters of environmental impact and for its pathogen reduction properties.
    - Identification of potential land fill sites in the high risk areas, starting with the San Joaquin Valley, has been started by the Workgroup.

Workgroup Efforts

The heat event of the summer of 2006 highlighted the importance of the state's rendering industry in providing safe and effective disposal of animal carcasses and demonstrated the limited surplus capacity of California's carcass disposal network. It also highlighted the need for coordinated efforts on the local, regional, state, and federal levels among the animal industry, government, the rendering industry and waste management industry. It became apparent to many local and State agencies, as well as affected stakeholders in the rendering, livestock and poultry industries, that changes were needed to be better prepared for subsequent emergencies.

CDFA and Cal/EPA staffs drafted and distributed a letter to potential stakeholders in June 2007 requesting participation in an "Emergency Animal Disposal Workgroup" (EADW). The goal of this initiative, jointly-lead by CDFA and Cal/EPA, was to examine the existing carcass disposal infrastructure and its capacity to absorb emergency surges resulting from such diverse events as natural disasters and disease outbreaks. California Public Health Officers and Environmental Health Directors encouraged the effort via a request to the agencies involved to work on solutions. The first EADW organizational meeting was held on July 20, 2007. CDFA provided funding to the Western Institute for Food Safety and Security (WIFSS) at the University of

California, Davis (U.C. Davis) to facilitate the EADW and to finance the collection of research data, and facilitate information exchange among stakeholders.

When the EADW was formed there were 28 individuals who agreed to participate. At the time of the writing of this document the EADW has more than 120 members.

New Challenges

Since the EADW began its efforts, several additional challenges have been identified. In April 2008, the United States Food and Drug Administration announced a modification of its feed ban. Brain and spinal cord from cattle 30 months of age or older may not enter the animal feed chain, creating an additional burden to the State's disposal system. Slaughterhouses handling older cattle are developing alternative disposal practices for brains and spinal cords. Rendering companies have to separate brains and spinal cords from older cattle carcasses and identify either an alternative use or disposal practice for that material. A critical prerequisite to a rendering facility's ability to separate brains and spinal cords from the remainder of the carcass is that the carcasses be fresh, meaning minimally decomposed. This is sometimes difficult when dealing with mortalities that are exposed to harsh environmental conditions. Because of poor carcasses conditions and/or practical issues involving removal of the brain and spinal cord, large quantities of material are expected to require diversion from rendering, especially during the summer. In a worst case scenario where rendering plants choose not to process cattle (something that has occurred in other states), some 252,456,923 pounds of carcasses (based on 2007/2008 estimates) would need to be disposed of by methods other than rendering. Alternate disposal options for such materials are problematic at this time. Additionally, the limitations on rendering brain and spinal material imposed by the United States Food and Drug Administration's "feed ban" of April 2008 is likely to reduce the number of carcasses that can be processed during an emergency.

Improved communication fostered by the EADW and new rule-making have also highlighted challenges facing the State's small ruminant producers. It has become evident that sheep and goat producers have limited options for sending mortality to rendering because only two rendering facilities (one in southern California and one in the Sacramento Valley) provide such service due to operational considerations. The generally low profitability of small ruminant operations also makes disposal costs a challenge for those producers. In addition, due to California's 1998 ban on horse slaughter, the disappearance of horse slaughter facilities nationally and the current economic situation, there is an increasing number of horses being euthanized, adding to the volume of material requiring disposal. Renderers are also concerned that the detection of drugs typically used to euthanize horses and livestock will cause their end products destined for feed to be considered "adulterated."

Finally, a key realization by the EADW partners has been the differentiation of three grades or levels of carcass disposal needs.

- The first level is routine, normal day-to-day disposal.

- The second level, perhaps the most difficult to define or resolve occurs when there is a surge in animal mortality or a technical event such a mechanical failure reduces the capacity of a rendering facility or facilities, but which is not large enough to trigger a local or state emergency declaration. An example of such an event is during the summer when animals that die over the weekend decompose to an extent that hide recovery is not possible and processing becomes very difficult. At the very least, producers will normally absorb extra costs passed on by the renderer for processing decomposed carcasses; at the worst, the carcasses cannot be rendered, or even be picked up from farm.

- The third level occurs when the system used for routine disposal is overwhelmed during an emergency and resources beyond the capacity of system are necessary. Perhaps the best and most recent example of this level of disposal challenge was the 2006 heat event in the Central Valley described above.

Summary

In summary, events involving animal carcass disposal elsewhere in the world, changes in regional rendering capacity, and a regional natural disaster in 2006 raised concerns about emergency animal mortality disposal to a level that resulted in stakeholders forming an ad hoc Workgroup to evaluate the situation and identify potential improvements. This report describes the current situation and identifies areas where improvements appear to be needed. It will be followed by subsequent activities that will provide options for addressing those challenges.

Section IV. Livestock Populations and Routine Mortalities

California is home to a diverse and thriving contingent of food-animal industries including dairy, beef, poultry, egg, and seafood production. Integral to the maintenance of those industries is the efficient and sustainable disposal of animal mortalities and inedible by-products of slaughter and food processing. The following information on the size, type, and location of the State's livestock and poultry populations is presented to provide perspective on both the economic role of food animals in California's economy as well as the magnitude of carcass and by-product disposal capacity required to serve the food-animal industry.

Putting California's Animal Agriculture in Perspective

Animal agriculture contributes enormously to the economy of California with the combined value of livestock, dairy, poultry and apiary (bee) products estimated at more than $12.1 billion for 2008. These numbers reflect only the value of the animals or products sold by the farmer/rancher, not the total economic activity it generates within California. For example, while the annual value of California dairy products is placed at about $4.5 billion there is approximately $47 billion annual economic activity when wages, taxes, and money paid to allied industries are included.

More than 20% of the US milk supply is produced in California, which has been the number one dairy state since 1993 when it surpassed Wisconsin. In addition, California is second only to Texas in production of sheep, ranked fifth for poultry production and tenth in beef production. Animal farming operations in California are diverse, and range from intensive Concentrated Animal Feeding Operations (CAFOs) to small pasture or "free-range" operations. There are large numbers of both conventional and organic animal agriculture operations in the State.

Animal Inventories

Reliable estimates of the numbers of farm animals by species (or class within each species) are available from the California Department of Food and Agriculture (California Ag Statistics Service), and from USDA's National Agricultural Statistics Service. CDFA also publishes an annual Crop Report, in which inventories and values of various agricultural commodities are listed, including livestock. The Crop Report contains details by county, indicating where in the state a particular species of farm animal predominates.

Because dairies in California are regulated by multiple agencies, it is easier to find statistical information for dairies than for other species. CDFA's Dairy Marketing Branch produces a comprehensive annual report titled "Cost of Milk Production" that provides specific information related to dairy production. The National Agriculture Statistical Service reports provided most of the other estimates.

Table 1 provides an estimate of the annual rolling average of California's various livestock and poultry populations, by species and class. The data reflect an average of the population expected over the course of a year, rather than a snapshot in time. The rolling average is the most useful population estimate because in some animal operations (turkeys and broilers for example), animals are marketed at less than a year in age. Animals of various age or production stage within each category may have higher or lower mortality rates. For example, poultry in the initial and in the final weeks of production have higher mortality than throughout most of the weeks in between. Newborn pigs, goats, and lambs have higher mortality before weaning than after.

Table 1. Animal Agriculture in California.

Animal Species/Class	Yearly Average of Total Number of Animals
Cattle and calves, all	5.45 million (NASS, 2008[a])
Dairy, cows calved	1.84 million (NASS, 2008[a])
Dairy, other[b]	1.97 million
Beef, cows calved	655 thousand (NASS, 2008[a])
Beef, other[c]	990 thousand
Poultry, layers	18 million (UCCE staff[e])
Poultry, pullets[d]	9 million (UCCE staff[e])
Poultry, broilers	281 million (2007 Census of Ag[f])
Poultry, turkeys	16.2 million (2007 Census of Ag[f])

Sheep, all	600 thousand (NASS, 2008 [a])
Goats, dairy	30 thousand (NASS, 2009 [a])
Goats, meat, fiber and other	104 thousand (NASS, 2009 [a])
Hogs, all	155 thousand (NASS, 2008) [a]

[a] National Agricultural Statistics Service
[b] primarily replacement heifers and calves
[c] steers, replacement heifers, and bulls
[d] pullets are replacements for the laying flock
[e] University of California Cooperative Extension
[f] 2007 Census of Agriculture State Profile, USDA – California Agricultural Statistics Service

Routine Versus Emergency Mortality Rates

Unusual environmental or disease events can cause surges in mortalities that require expedited disposal. As described previously, the heat and humidity event in 2006 resulted in more than 40,000 additional dairy cow and calf mortalities as well as the death of more than one million chickens and turkeys. A different example of emergency mortality was the depopulation of nearly 4.5 million birds during California's 2003 outbreak of exotic Newcastle Disease. A large-scale Foot and Mouth Disease outbreak in California, such as occurred in 2001 in the United Kingdom, could result in hundreds of thousands of animal mortalities requiring disposal.

Regional Animal Concentrations and Potential Emergency Disposal Options

The livestock demographics and disposal resources cited below are intended to capture what disposal options might potentially be available in the event of an animal mortality surge in a given geographic region. Implicit in this discussion is the assumption that nearby landfill or rendering facilities were permitted to receive mortalities from a given emergency declaration area. As demonstrated in 2006 however, mortalities from one county might not be received for landfill or rendering in another. This regulatory obstacle highlights one important solution to future disposal crises: those declarations of emergency include neighboring counties' access to regional rendering facilities.

Del Norte, Humboldt and Mendocino Counties: There are approximately 20,000 milk cows plus replacement stock, and calves in the northwest corner of the State[5]. Some dairies in this area are located in a flood plain and others in coastal hills. The closest California rendering plant that processes dead stock is in Butte County, and would likely not be able to receive mortalities from an animal emergency. The hauling distance and permit restrictions on the type and daily tonnage of material approved would also make disposal in the closest landfills problematic. The current mortality disposal practices in this region have not been well described but legal disposal options appear limited. Additional research into this region's routine and emergency disposal options is warranted.

[5] California Dairy Statistics 2009 (California Department of Food and Agriculture)

Napa, Sonoma and Marin Counties: Although animal industry operations in this area are reduced in number from previous decades, the area still has some poultry production and approximately 37,000 milk cows plus associated replacement heifers and calves. The dairies and poultry facilities are in relatively close proximity to human population centers as well as exist in a sensitive water basin. In addition the area has challenging roads for transport of large-volumes of material. The two closest rendering plants are in Sacramento and Butte Counties, and both are modest in size. Location of the rendering plants relative to the boundaries of a declared emergency could be an issue. Aside from renderers, other legal disposal options have not been well summarized on a county-by-county basis.

Upper Sacramento Valley from Glenn to Shasta Counties: There are a significant number of range cattle in this region as well as approximately 23,000 milk cows and associated young stock in Glenn and Tehama Counties. Because of the expansive nature of range cattle production, the limited concentrated animal production this area may present fewer challenges in an animal mortality emergency. The closest rendering facility is in the Chico/Oroville area of Butte Country, and another rendering facility is located in Sacramento County. On-site disposal of dairy mortalities in this area is prohibited by the Central Valley RWB and that prohibition affects response options during an emergency animal mortality event.

Central Sacramento Valley and the San Joaquin Valley from Yuba/Sutter Counties south to Kern County: This area is the most significant in the state for dairy and poultry production. Millions of commercial birds including layers, broilers, and turkeys are produced in this area. More than 1.5 million milk cows plus their associated replacement stock (heifers and calves) are also located here. There are four rendering plants in the region that process dead stock but as discussed in the introduction to this section, rendering facilities in one county have not always been able to accept mortalities from another. Additional factors that make mortality disposal challenging in this area include the prohibition of burial of dairy mortality, the proximity of animal facilities to each other (introducing bio-security challenges for infectious diseases), the high human and animal population density, the use of feedlots and slaughter facilities in this area for livestock raised in other parts of the State, and the small amount of land at some animal facilities which is potentially available for on-site burial or composting of mortality. In addition the shallow water table in much of the area is a concern for some types of mortality disposal.

Central Coast Region - Monterey, San Luis Obispo, Santa Barbara and Ventura Counties: Because its large watershed drains into reservoirs and the ocean this region is environmentally sensitive. The primary livestock production activity in this region is grazing, with over 211,000 cattle and a combined 27,000 sheep and goats on pasture[6]. There is only one rendering company in the region, and access to landfills for carcass disposal is also limited.

Southern California: Although the dairy population in this area is declining, there are still approximately 155,000 dairy cows and associated young stock in the area. The area also has a significant number of layers south of the Tehachapi Mountains, and over 400,000 head of cattle,

[6] National Agriculture Statistics Service

primarily feeders, in Imperial County. The only rendering facilities in the area are located in a highly urban area (Vernon), complicating their use during animal disasters in San Diego or Imperial Counties, the Chino Valley or Hemet/San Jacinto area. Limited agricultural land availability, groundwater protection issues, and congested roads all present additional challenges to managers during an animal mortality emergency.

Section V. Carcass Disposal Methodologies: A Brief Review

To plan for future routine and emergency carcass and by-product disposal needs, it is necessary to have a basic understanding of the disposal methodologies that are available. Table 2 and the rest of this section summarize the technical and legal status of various disposal methodologies which have been used, or might be used, for disposal of mortalities in California. Appendix A provides a more detailed comparison of methodologies.

Rendering. Rendering is the process by which animal carcasses (and by-products of animal slaughter), food processing waste, and inedible restaurant-kitchen grease are heated and processed to ultimately become constituents for a variety of products. Such products include livestock and pet feed, lubricants, paints, soaps, candles, biofuels, cement, and gelatin. Compared to other disposal options, rendering may reduce emissions of greenhouse gasses by recycling carbon and nitrogen (Hamilton, testimony before U.S. Senate Committee on Agriculture, Nutrition and Forestry). Some 250 million pounds of livestock mortalities and 725 million pounds of poultry mortalities and offal are processed annually in California alone. Most rendering facilities will use maximum temperatures typically in the range of 245ºF to 290ºF, well in excess of temperatures sufficient to destroy disease organisms. Rendering is the most sustainable and economical of all the methods of animal disposal. The United Kingdom has recognized that animal waste collection "constituted a vital public service" aside from being an important commercial activity. Too many variables exist to accurately estimate an average cost for a producer including a) distance to haul, b) type and quantity of material, c) condition of material, and d) existing service agreement vs. on-call service.

Landfill Disposal. Modern landfills protect groundwater by proper site preparation, composite liners, and monitoring. Costs (including "tipping fees") may be higher than for on-farm burial by three fold. Disposal of routine mortality in landfills is limited because transportation to a landfill is allowed only under specific conditions by law as described in Section VII. In addition many landfills do not include animal mortalities as accepted materials in their operating permit and could require that their permit conditions be addressed via an emergency declaration in order to receive carcasses. In addition, transporting mortalities to a landfill presents a significant bio-hazard if the carcasses are contaminated with highly infectious pathogens such as Foot and Mouth Disease virus or anthrax. Burial of mortality in landfills can result in release of methane and CO_2, as is true for most disposal options.

Table 2. Disposal Methodologies Available to Producers in California.

Methodology	Legal for livestock	Legal for poultry	Comments

Rendering	Yes	Yes	Principal and optimal disposal technology for mortalities and animal by-products in California. Cattle carcasses of animals older than 30 months of age must have the brain and spinal cord removed or the entire carcass may not be rendered. Carcasses too decomposed for rendering may not be picked up.
Landfill Disposal	See comments	See comments	As of January 1, 2010, dead animal haulers may acquire a CDFA permit under specified conditions (e.g. declared emergency or certification from a licensed renderer that the carcass cannot be processed) to transport mortality to landfills. Mortality can only be disposed at a landfill if the facility's operational permit lists carcasses as acceptable material during non-emergency periods. A promising alternative is to partially compost (2 to 3 weeks) a cow and deliver the carcass and composting material (normally manure) to the landfill.
Burial, pit or trench	See comments	See comments	On-site burial may be allowed in limited areas of the State. For emergencies, on-site and off-site pit or trench burial could be permitted under emergency proclamation, but the local environmental health agencies and regional water boards must concur.
Composting	No	Yes	It is illegal to compost unprocessed mammalian tissue[7] in California. Emergency composting can be permitted under emergency proclamation, but the local environmental health agencies, regional water boards and air districts must concur. On-site composting of poultry is legal providing local entities do not prohibit it
Incineration	See comments	Yes	Enclosed incineration can be permitted but operating conditions restrict volume and location. It can be permitted under emergency proclamation but open burning is often the last option. The local air district would need to concur.

Trench or Pit Burial. Historically, burial has been the most commonly used disposal method during mortality surges due to animal disease outbreaks, poisoning or natural disaster. Burial allows disposal of a large number of animal carcasses without specialized equipment. It is the most economical method of disposal, and costs may be as low as $15 for an adult cow carcass[8]. Burial offers an important advantage relative to disease control, because it can be accomplished without transporting infectious materials to landfills or other sites. The primary disadvantage of burial is that it may result in the discharge of pathogens or degradation products from the burial site into ground or surface waters, and many regulatory authorities prohibit

[7] including but not limited to, flesh, organs, hide, blood, bone and morrow is prohibited, except when from the food service industry, grocery stores, or residential food scrap collection, or as part of a research composting operation for the purpose of obtaining data on pathogen reduction or other public health, animal health, safety, or environmental concern (14 CCR 17855.2. Prohibitions)

[8] Except where otherwise stated cost estimates are from "Carcass disposal: A comprehensive review", National Agriculture Biosecurity Center Kansas State University, 2004

routine burial of mortalities for this reason. Also, on-site burial of mortality results in release of methane and CO_2. Except when allowed during a declared emergency, on farm disposal burial of dairy mortality is not allowed by the Central Valley Regional Water Quality Control Board. On-farm burial in other geographic locations in the state may also be regulated by their respective regional water boards.

Composting. California State law currently permits and regulates the composting of poultry, but prohibits composting of unprocessed mammalian tissue except for research purposes. Properly managed, composting can fully biodegrade poultry carcasses in 30 days. In states where bovine carcasses are allowed to be composted, it is reported that more than 90% of the flesh of a mature dairy cow will be decomposed after six to eight weeks of composting, and after six to twelve months of composting, all that remains will be bones that tend to be brittle and break into small pieces. In 2009, the EADW conducted research studies on composting dead, whole dairy cows using dairy manure as the cover material for the compost pile. The aerobic composting process is exothermic, and during the EADW studies, temperatures in the composting mass exceeded 145°F for several weeks, substantially exceeding the US EPA's target time and temperature (131°F) for Class A Biosolids. The studies showed that the final product of bovine carcass composting, when performed under properly controlled conditions, will be free of pathogens and weed seeds. The resulting compost has many of the attributes of an excellent fertilizer and soil amendment for forage crops. Some technical expertise is required to use composting to process livestock and poultry mortalities. The expertise primarily relates to selecting appropriate bulking materials, properly constructing piles or windrows, and maintaining adequate moisture and oxygen content of the composting mass. Improperly sited or inadequately maintained composting operations have the potential for significantly degrading the environment, particularly if leachate is allowed to reach ground or surface water, and for generating intense malodors. The USDA has reported the cost of cattle composting to range from $50 to $104 per head. The cost of machinery (the major fixed cost) represents almost 50% of the total cost per head. Even if regulations are changed to allow composting of mammals, both the local Air Quality Management District or Air Pollution Control District and RWB must approve the composting operations before they are initiated. Another use for composting is as a "pre-treatment" of carcasses prior to burial in a landfill, something that was explored in the heat event in 2006. In this model cow carcasses are partially composted for 2 to 3 weeks after which the carcass and composting material (normally manure) were delivered to the landfill. Landfill operators found cattle carcesses processed in this way far easier to manipulate.

Incineration (open air, forced air curtain and fixed-facility). Open air burning (pyres) are relatively expensive, labor and fuel intensive, weather dependent, and have resulted in significant air and water pollution. In addition when large scale incineration has been applied during emergency disposal events, public acceptance has been a significant obstacle. The relatively low temperature achieved by open air burning make it unsuitable for prion-infected carcasses. Likewise, the volume of emissions and impacts to air quality in California makes this methodology undesirable in California.

The use of Air Curtain Destructors (ACDs) can increase incineration rate six fold over open air burning, achieve much higher temperatures, and minimize discharge of pollutants. While ACDs can be logistically challenging, the units are mobile and transportable and increase disaster-response capabilities. ACDs achieve high temperatures (1,800 to 2,200 degrees Fahrenheit) and significantly minimize discharge of pollutants, including those that impact air quality. When properly operated, ACDs can reduce the volume of debris by 80 to 90 percent. ACDs vary in size and type and are suitable for mass reduction of debris, including animal carcasses.

After disasters, skilled technicians have used ACDs to destroy and dispose of millions of tons of waste debris, including cattle, poultry, and swine carcasses, Due to the high temperatures achieved by the units, pathogens, hides, wool, bones, teeth, and prions are completely destroyed. It is reported that larger ACD units can completely destroy three dairy cow carcasses in 20-25 minutes, or slightly over 200 carcasses in 24 hours. Multiple units could be used to destroy approximately 2,500 dairy cows in 2 to 3 days.

Some purveyors of ACDs are Government Service Account (GSA) contract holders and have been approved by the United States Environmental Protection Agency (USEPA) to use ACDs in many situations. Use of ACDs has been authorized by the USEPA, US Army, Army Corp of Engineers, Air Force, Navy, FEMA, California State Parks Department, and others. ACDs have been used extensively in the clean-up of hurricane disasters and wild-land fires, including but not limited to hurricanes George, Andrew, and Katrina, and the Palomar and San Diego wildfire events in California.

When carcasses are destroyed in ACDs, a supply of wood or other clean, combustible fuel must be utilized in a one-to-one ratio by weight to the animal carcasses. The supplemental fuel is necessary for the units to function efficiently and effectively. Suitable combustible fuels include wood pallets and green waste or wood waste from sanitary landfills, transfer stations, and co-generation facilities. The cost of equipment operation is dependent upon the current local price of diesel fuel, with a fuel consumption rate of two (2) gallons per hour per unit. Units may be operated continuously for 24 hour periods. Equipment transportation charges and labor will vary depending upon the current local economic conditions, distance traveled and the current local rate of pay for one technician, classified as a heavy equipment operator. Equipment only lease charges in 2010 dollars are approximately $8,000 per month or roughly $12.00 per hour. This does not include the variable cost for augmented wood waste and combustibles. Cost is dependent upon the number of units utilized, items enumerated above, combustible material availability and location.

There are no incinerators (crematoriums) in the State that routinely accept livestock carcasses or large numbers of poultry mortalities. For technical and regulatory reasons, power generation plants (also “fixed facilities”) do not generally accept animal carcasses. Incineration costs vary significantly depending on equipment and the amount and type of fuel used. The cost of incineration per ton of carcass has been reported to range from $98 to $2000.

Other Technologies. There are several other disposal technologies (lactic acid fermentation, alkaline hydrolysis, anaerobic digestion) which may eventually supplement or supplant some of the more traditional methodologies listed above. These technologies are discussed below.

- *Lactic acid fermentation* is viewed primarily as a way to preserve carcasses until they can be rendered. Mortalities are size-reduced to about a one-inch particle size, a fermentable carbohydrate source and inoculants are added and the mix is sealed in a non-corrosive container. Under optimal conditions, the pH of fresh carcasses is reduced to less than 4.5 in two days. Most viruses and bacteria will be inactivated in 2-4 days. Any appropriately sized corrosion-resistant container can be used. It was estimated that eight railroad cars could provide adequate volume to ferment 1000 cattle averaging 1,100 pounds each. Including the purchase of tanks, costs for fermentation of livestock have been estimated at about $650/ton.

- *Alkaline hydrolysis* uses heat and sodium hydroxide or potassium hydroxide to hydrolyze a carcass into solution, leaving only about 2% of the original mass and destroying all pathogens. Once the pH of the solution is neutralized, the resulting solution can be released into a sanitary sewer with the concurrence of the wastewater treatment plant operator. The process does not produce atmospheric emissions, and is the method of choice for disposing of potentially prion-infected material. A mobile trailer unit is reported to be able to process approximately 12,000 pounds every 24 hours. Labor, chemicals, and sanitary sewer costs for one ton of material are estimated at $320. A mobile trailer unit costs approximately $1.2 million.

- *Anaerobic digestion* can be used for processing animal mortalities. Within the anaerobic digestion reactors, anaerobic microorganisms decompose previously sized-reduced carcasses, producing biogas (primarily methane and carbon dioxide), sludge, and a liquid effluent. Large anaerobic digestion digesters are technically complex and typically require five to nine months to construct and bring on-line. From a regulatory stand-point in California, anaerobic digestion is considered a form of composting with the same legal ramifications. Once operational, they can efficiently process large volumes of carcasses daily. The reactors are typically operated at mesophilic or thermophilic temperatures (about 95 to 131 degrees F), depending on the operating conditions, desired performance characteristics, and designer preference. As opposed to the process of aerobic composting, which is exothermic, the process of anaerobic digestion typically requires the input of external energy (heat) into the process in order to reach and maintain operating temperature. Initial construction costs have been estimated at approximately $65,000 to $ 76,000 per ton of daily capacity.

<u>Selecting the Optimal Disposal Technology for a Particular Disposal Event</u>

There are numerous considerations in the selection of method(s) for disposal. Factors include:

1. Carcass location(s) particularly the proximity to water, people and other animal populations;
2. The volume of carcass material to be disposed;
3. Type (species) and size of carcasses to be moved;
4. Cause of death (physical, chemical or microbiological);
5. Fragility of the local environment and the disposal's potential adverse impact on it; and,
6. Rapidity by which disposal can be accomplished.
7. Regulatory restrictions to use of specific methods.

The cause of the mortality is important as it might involve a toxin, contagion, or chemical that must be considered for containment and destruction reasons. Transportation of carcasses from the site of death to the site of disposal must be evaluated in light of potential of further spread of contagion and whether or not additional biosecurity measures should be implemented. Logistical challenges presented by transportation from the site, particularly when moving large number of carcasses, must be considered. Delays in acquiring the necessary disposal equipment can lead to more extensive degradation of the carcasses, further complication carcass handling. Rapid deterioration of carcass tissue adversely impacts transportation and handling of carcasses but may also cause additional problems with generation of malodors and attraction of vectors. Carcass stabilization techniques (refrigeration, composting, adding adsorbents) may be needed to mitigate these problems. Alternatively, employment of multiple disposal techniques could be used to speed up the process in order to address carcass decay.

Assessment of a disposal method must include evaluating the impact on competing material which also requires disposal. For instance, the choice of a landfill or of a rendering plant could be affected by the other materials being received such as debris from a natural disaster or offal.

When choosing between on-site and off-site disposal additional considerations include the availability of appropriate personnel, materials, and equipment. In some cases, it may be best to bring the workers and material to the site, while in other situations (a landfill or rendering plant) it is best to take the carcass material to the disposal site. The decision to use composting will be affected by the availability of bulking (co-composting) material and accessible land.

In some situations, local environmental conditions may dictate what disposal method can be used relative to protection of air, water, and soil. Also, the resources available within a declared emergency zone versus accessibility of resources outside the zone will impact the selection of disposal method. For instance, although a rendering facility or landfill outside an emergency zone may be within a reasonable hauling distance from a disaster site, regulatory restrictions may not allow use of those facilities, and a facility within the declared emergency zone would be the only allowed option.

Given the many relevant factors, disaster managers facing a large-scale disposal event will frequently opt to use several disposal methods in order to make efficient use of available resources, deal with decaying matter rapidly, and minimize impacts on animal health, human health, and environmental quality.

Section VI. Routine Disposal Methods and Patterns

Disposal of Cattle. FAC Section 19348 only allows dead cattle to leave the farm premises by transport to: 1) a licensed rendering plant, 2) licensed rendering collection center, 3) an animal disease diagnostic laboratory, 4) the nearest crematorium, 5) out-of-state with regulatory approval by the destination state 6) an alternate site under the state veterinarian's quarantine authority and 7) as of January 2010 to a landfill by permit of the Secretary during declared emergencies or if a license renderer certifies that it cannot process the carcass. The practical effect of this law is that cattle mortalities are typically only transported to a rendering plant or a collection center serving a rendering plant. However, if not prohibited or restricted by State or local regulations, the owner of an animal may dispose of it by burial on his own property, either where the animal died or in close proximity.

In January 2010 additional regulatory flexibility (item #7 above) was created allowing disposal of dead cattle in a landfill during local or State emergencies or under permit by the Secretary of Food and Agriculture. In addition, the State Veterinarian may grant a waiver (through the use of a "Notice of Quarantine") allowing livestock to be transported to alternative locations. Even when such a waiver is implemented, additional restrictions may apply. Landfills, for instance, have to comply with State and local regulations as well as their own regulatory permits. Landfill permits may limit the type and amount of material accepted, days or hours of operation, etc. During emergencies, State or local agencies may also issue emergency proclamations making other forms of off-site disposal options available.

Disposal of Poultry. FAC Section 19348 only allows dead poultry to leave the farm premises by transport to: 1) a licensed rendering plant, 2) licensed rendering collection center, 3) an animal disease diagnostic laboratory, 4) the nearest crematorium, 5) out-of-state with regulatory approval by the destination state 6) an alternate site under the state veterinarian's quarantine authority and 7) as of January 2010 to a landfill by permit of the Secretary during declared emergencies or if a license renderer certifies that it cannot process the carcass. The practical effect of the laws is that poultry mortalities typically go to a rendering plant or are disposed of on-site. Unlike mammals (cattle, pigs, sheep and goats), poultry mortalities can be composted on-site (meaning the production facility) in California, but can't be transported off-site for composting at a different location. On-site composting of poultry carcasses are subject to State and local regulations, and a permit may be required. The level of regulatory involvement will depend on a variety of factors including the type and source of compost materials, the volume of composted material produced, and the intended use of the finished product. Composting regulations are administered at the local level by the local enforcement agency (LEA) that is usually within an environmental health department or division. For producers with questions regarding on-site disposal of poultry or poultry composting the most knowledgeable source is the agency or department in the relevant county that deals with environmental health issues associated with solid waste in the county where the animal facility is located. The local RWB

and Air Quality Management District/Air Pollution Control District may also regulate on-site composting activities.

Types and Tonnage of Material Rendered in California

For a variety of reasons, including protection of human, animal and environmental heath, and recycling potential, rendering remains the optimal disposal methodology for animal carcasses. Below are data depicting the types and tonnage of material that is rendered in California. A primer on rendering technology is included in Appendix B.

The Pacific Coast Rendering Association (PCRA) has provided data in regards to the type and quantity of incoming materials they recycle which includes animal mortalities (Table 3). Accurate information relative to the volume of carcasses disposed of using different methodologies, such as cremation, shipment out of state and on-site or landfill burial, is not generally available.

Table 3. Pacific Coast Rendering Association. Census of Incoming Materials.

Year (Fiscal) →	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007	2007/2008
Plants →	16	14	13	16	18	16
↓ Materials ↓	(Pounds)					
Fat & Bone	380,151,606	349,948,275	320,873,523	334,059,573	351,426,382	391,306,633
Slaughterhouse/Custom Kill Offal	594,622,674	513,436,931	432,788,738	614,135,282	647,877,408	544,310,914
Restaurant Grease	302,877,046	361,750,234	261,891,139	320,613,875	315,286,835	321,719,901
Dead Animals	222,472,770	226,093,878	231,728,123	229,253,792	212,892,817	252,456,923
Poultry/Dead Birds and Offal	713,387,166	660,183,340	663,111,746	682,436,784	683,390,070	725,624,860
Fish/Seafood Waste	29,279,525	9,166,120	8,681,965	8,416,115	8,842,440	14,925,924
Trap/Interceptor Grease	58,335,065	91,045,318	89,699,010	117,797,658	66,917,124	87,147,531
All other	95,225,145	46,655,079	36,413,550	41,668,362	59,640,852	98,768,885
Total	**2,396,350,997**	**2,258,279,175**	**2,045,187,794**	**2,348,381,441**	**2,346,273,928**	**2,436,261,571**
Number of Dead Animals Processed (Ovine, Bovine, Porcine)	406,130	694,855	417,644	439,822	414,029	534,657
Number of Cows (Dairy) Picked Up			192,767	199,474	173,251	187,090
Number of Steers (Feed Lot) Picked Up			7,136	8,144	3,283	7,152
Number of Calves Picked Up			205,159	240,833	229,243	329,438

Section VII. Emergency Livestock Mortality Disposal: Regulatory Considerations

This section describes various regulatory requirements relative to declared emergencies, and presents several tools currently available for persons assessing when and how to proclaim an emergency.

Regulatory Requirements

Declaration of a Local Emergency

A local emergency can be declared (proclaimed) when conditions threaten the safety of persons and/or property within the jurisdiction of a city and/or county. Most often, the declaration is made in response to a situation that has progressed, or is anticipated to progress, beyond the capability of local government resources to control. In some cases, a local jurisdiction will make a declaration when there is a need to enact special local powers (e.g., to waive hiring, contracting, or purchasing requirements, enact emergency ordinances, or provide special powers to deal with an event). From the California Government Code:

> "*'Local emergency' means the duly proclaimed existence of conditions of disaster or of extreme peril to the safety of persons and property within the territorial limits of a county, city and county, or city, caused by such conditions as air pollution, fire, flood, storm, epidemic, riot, drought, sudden and severe energy shortage, plant or animal infestation or disease, the Governor's warning of an earthquake or volcanic prediction, or an earthquake, or other conditions, other than conditions resulting from a labor controversy, which are or are likely to be beyond the control of the services, personnel, equipment, and facilities of that political subdivision and require the combined forces of other political subdivisions to combat, or with respect to regulated energy utilities, a sudden and severe energy shortage requires extraordinary measures beyond the authority vested in the California Public Utilities Commission*[9]*."*

Appendix C contains a reference titled, "*Emergency Proclamations: A quick reference guide for local government*." The guide contains general information about local emergency proclamations, description of the levels of disaster assistance, and a sample emergency proclamation.

Declaration of a State Emergency

A State emergency can be declared (proclaimed) when conditions threaten the safety of persons and property within the State of California. A State emergency is defined as:

> "*'State of emergency' means the duly proclaimed existence of conditions of disaster or of extreme peril to the safety of persons and property within the state caused by such conditions as air pollution, fire, flood, storm, epidemic, riot, drought, sudden and severe energy shortage, plant or animal infestation or disease, the Governor's warning of an earthquake or volcanic prediction, or an earthquake, or other conditions, other than conditions resulting from a labor controversy or conditions causing a "state of war emergency," which, by reason of their magnitude, are or are likely to be beyond the control of the services, personnel, equipment, and facilities of any single county, city and county, or city and require the combined forces of a mutual aid region or regions to combat, or with*

[9] Government Code, Section 8558(c)

respect to regulated energy utilities, a sudden and severe energy shortage requires extraordinary measures beyond the authority vested in the California Public Utilities Commission[10]."

A Governor's State of Emergency Proclamation can be requested by any local government entity or by the California Emergency Management Agency (Cal-EMA). It can also be proclaimed by the Governor independent of a request from a local government or the Cal-EMA Secretary.

Local government requests for a state of emergency proclamation are evaluated by the Cal-EMA Secretary. The submission making the request should include:

a. A local government resolution, which includes a description and nature of the emergency;
b. Date(s) of the emergency;
c. A designated point-of-contact to receive, process, and coordinate all aid;
d. Copy of the Local Emergency Declaration; and,
e. Initial Damage Estimate.

Cal-EMA prepares the necessary paperwork outlining the basis for a request and, if appropriate, drafts a "State of Emergency Proclamation" and makes a recommendation regarding the appropriate course of action for the Governor's consideration.[11]

State Agency-specific Waivers

California Emergency Management Agency

Standby Order 8. Standby orders are orders prepared in advance of a State of Emergency and used by the Governor to direct State agency assignments during a State of Emergency. Cal-EMA maintains a number of standby orders. Relative to disposal of animal carcasses, Standby Order 8 reads as follows:

"*It is hereby ordered that during a proclaimed State of Emergency, in order to protect the health and welfare of the human and animal populations within California, application of all state and local laws, regulations, and ordinances regulating environmental quality standards may be waived only to the extent necessary to allow for the successful disposition of large numbers of animal carcasses which would exist should the emergency affect a livestock, poultry or wildlife population. A waiver shall constitute an action separate from the action taken to declare an emergency and shall not be granted unless essential to the health and welfare of human or animal populations as determined by the Director, California Office of Emergency Services. All actions taken to dispose of animal carcasses under this Order shall include all reasonable efforts to minimize any detrimental effects on the environment.*

[10] Government Code, Section 8558(b)
[11] All-Hazards Food and Agricultural Response Template, Stanislaus and Fresno Counties (pgs 18-22)

"Actions taken under this Order shall be coordinated with the Secretary, Department of Food and Agriculture, and the Secretary, California Environmental Protection Agency, with priority established by the Director, California Office of Emergency Services, but shall not extend beyond the termination date of said State of Emergency. Any action involving the burning or rendering of carcasses shall only be done after consultation with the Air Resources Board. [Originally approved by the California Emergency Council on 10/27/83]."

California Department of Food and Agriculture

Under FAC, Section 9562, the State Veterinarian may impose a quarantine if he or she believes, upon any basis reasonably supportable by standard epidemiological practice or credible scientific research, that a population of domestic animals or food product from animals has contracted, or may carry, an illness, infection, pathogen, contagion, toxin, or condition that, without intervention, could transmit an illness that could kill or seriously damage other animals or humans. The State Veterinarian's quarantine powers expressly include the power to order movement, segregation, isolation, or destruction of animals or food products, as well as the power to hold animals or food products in place. This has been the authority that has allowed the landfilling of mortalities.

FAC 19348 prescribes where carcasses can be transported to, if leaving the farm for disposal (licensed rendering or collection center, nearest crematorium, diagnostic laboratory or disposal site outside of the state). It also acknowledges the State Veterinarian's quarantine authority (FAC Section 9562) to allow for transportation and disposal by other means when there is an animal or public health issue that must be mitigated by means other than what is provided in FAC 19348.

In January 2010, FAC Section 19348 was amended by Assembly Bill 1249 (Galgiani) Chapter 280, Statutes of 2009, to provide the Secretary of CDFA with additional flexibility for authorizing transport of a dead animal to a permitted landfill. The Secretary may issue a master or individual permit to a licensed renderer, collection center, or dead animal hauler under either of the following circumstances:

(1) During a proclaimed state of emergency or local emergency, as defined in subdivisions (b) and (c) of Section 8558 of the Government Code.

(2) When a licensed hauler has certification from a licensed renderer, that the licensed renderer cannot process the dead animal due to operational conditions or legal or regulatory requirements or constraints.

California Environmental Protection Agency

In 2004 Cal/EPA published a guidance document entitled, "*Cal/EPA Emergency Animal Disease—Regulatory Guidance for Disposal and Decontamination*." Other agencies, specifically the CDFA and the California Department of Health Services (now the California Department of

Public Health) assisted in the development of this document. The document is a partial guide to State regulatory programs that may, in the discharge of their respective responsibilities impact disposal and decontamination options in the event of an emergency animal disease outbreak. It may also serve as a resource for others involved in contingency planning for such an event. The document contains agency-specific authorities and responsibilities of each of the boards, departments, and offices comprising Cal/EPA.

- California Department of Resources Recycling and Recovery
  (*Including the former California Integrated Waste Management Board or CIWMB*)

  In the event of a state of emergency or local emergency, regulations[12] administered by the CIWMB and CIWMB-certified Local Enforcement Agencies (LEAs) allow an operator of a solid waste facility (which includes landfills and composting facilities) to apply for an emergency waiver of standards.

  The waiver grants an operator temporary relief from specific regulatory standards (e.g., waste type) or specific terms or conditions of a solid waste facility permit (e.g., hours of operation, daily tonnage). The regulations also allow an LEA to issue a waiver for a locally-approved temporary composting activity.

- Central Valley Regional Water Quality Control Board

  Regional Water Quality Control Board, Central Valley adopted a Conditional Waiver of Waste Discharge Requirements[13] for disaster-related wastes in June 2008. The waiver applies to dischargers who operate landfills that accept emergency/disaster related wastes or mass mortality wastes, dischargers operating a temporary waste pile or temporary surface impoundment in a disaster-stricken area, or dischargers constructing an emergency landfill for mass mortality wastes within the Central Valley Region. The waiver provides a mechanism for management and disposal of disaster-related wastes that result from fires, floods, storms, earthquakes, and mass mortality of animals when a state of emergency is proclaimed by the Governor.

  The Emergency Waiver can also be used or for other emergencies not in a Governor-declared disaster area for actions to mitigate an emergency as defined in the California Environmental Quality Act.

Declaration of a Federal Emergency or Major Disaster

A federal emergency can be declared to announce the existence of conditions of disaster or of extreme peril to the safety of persons and property within the territorial limits of a county, city, or county and city, and for which federal assistance is being made available.

[12] 14 CCR 17210-17210.9: *Emergency Waiver of Standards*

[13] Order No. R5-2008-0093, Conditional Waiver of Waste Discharge Requirements for Disaster-Related Waste During a State of Emergency Within the Central Valley Region

There are two types of federal declarations: an “Emergency” and a “Major Disaster.” An "Emergency" means any occasion or instance for which, in the determination of the President, federal assistance is needed to supplement state and local efforts and capabilities in order to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States."

A "major disaster" means “any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm or drought), or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby."

The President of the United States can proclaim a Major Disaster:

(1) Only when a situation is of such severity and magnitude that effective response is beyond the capabilities of local and state governments, and;
(2) Federal assistance under the Stafford Act is necessary to supplement the efforts and available resources of the state and affected local governments.[14]

Decision Making Resources

Disposal Option Decision Tree

Disposal decisions should be made after consultation with public health, animal health, and environmental oversight agencies. Factors that will influence disposal decisions include cause of death, urgency of disposal, location, scale of disposal need, costs, and environment oversight concerns. A decision tree collaboratively developed by several state agencies offers basic guidance for emergency mortality disposal decisions (see Appendix D). Actual disposal methods will be determined on a case-by-case basis, and the decision-making process will likely involve additional factors.

California Environmental Protection Agency

In addition to the agency-specific authorities and responsibilities referenced above, the Cal/EPA document entitled, “*Cal/EPA Emergency Animal Disease—Regulatory Guidance for Disposal and Decontamination*” contains guidance on the development of a removal hierarchy, including a carcass disposal decision tree.

[14] All-Hazards Food and Agricultural Response Template, Stanislaus and Fresno counties (pgs 18-22)

USDA NAHEMS Plan

As a part of their emergency planning for contagious disease outbreaks in livestock and poultry, the United States Department of Agriculture Veterinary Services has detailed guidelines for carcass disposal that can be used in disasters. The guidelines are a part of the National Animal Health Emergency Management System Plan.

Homeland Security

The White House Homeland Security Council tasked the United States Environmental Protection Agency with coordinating with the U.S. Departments of Agriculture, Health and Human Services, Defense, and Homeland Security to document Federal food and agriculture decontamination and disposal roles and responsibilities. The agencies developed a document entitled, "*Federal Food & Agriculture Decontamination & Disposal Roles & Responsibilities*." This document describes the general Federal roles and responsibilities for decontamination and disposal in response to animal, crop, and food incidents. Federal roles are described for incidents at three levels of magnitude: 1) Local/Limited Response, 2) State/Regional Response, and 3) National Response. Discussions are limited to incidents involving chemical or biological agents.

Most decontamination and disposal actions are handled at the local level, not by the Federal government. The private sector holds 85% of the nation's food and agricultural assets and will have a key role in response actions. Thus, the Federal role is most often one of technical assistance and advice, not direct implementation. Federal agencies will generally serve in an operational role only after state/local/private resources are overwhelmed.

Section VIII. "Sub-Emergency" Mortality and Disposal Surges

For the purpose of this discussion paper, "sub-emergency" means the existence of conditions requiring mortality disposal which, while they exceed the available routine disposal services, do not warrant or at least result in a proclamation of a "local emergency" by a local governing body or a "state of emergency" by the Governor to address conditions of disaster or extreme peril (see Section VII).

Examples of conditions that may result in a sub-emergency include: accelerated decomposition of carcass condition and temporary service interruptions/disposal surges.

The vehicles used by haulers to transport mortalities to rendering facilities are equipped with a hoisting mechanism to load mortalities. The carcass must maintain its physical integrity when being hoisted into a vehicle. If the carcasses are too decomposed the hauler may be unable to load it with their normal equipment. The two most important factors affecting the rate of decomposition are ambient temperature and time. Higher ambient air temperatures lead to faster decomposition. This makes timely service of the mortalities critically important.

For economic reasons, rendering capacity is sized to handle routine flows of all input materials, including mortalities. In the event that excess mortalities enter the system (e.g., as a result of heat events) the capacity of our rendering infrastructure can be challenged or exceeded. In addition to weather events, excess mortalities have resulted from temporary service interruptions at rendering facilities due to unscheduled maintenance or repair. Numerous other conditions or events can result in increased livestock mortalities that exceed normal rendering capacity including isolated disease or toxicity events involving only limited numbers of animals and food recalls involving contaminated or out-of-date product requiring disposal.

The disposal of mortalities resulting from sub-emergency conditions offers unique logistical and regulatory challenges. Typically during a sub-emergency, adequate routine disposal options are not available, and there is no implementable mechanism to waive existing law to allow for alternative disposal options. When rendering is not feasible or available, permitted solid waste landfills offer one of the most viable alternative disposal options.

Until January 2010, FAC Section 19348 prohibited the transport of mortalities to landfills during a sub-emergency without a waiver via the State Veterinarian's quarantine authority. Assembly Bill 1249 (Galgiani) Chapter 280, Statutes of 2009, improved the State's ability to respond by amending FAC 19348 to provide the Secretary of CDFA with additional flexibility for authorizing transport of a dead animal to a permitted landfill. The Secretary may issue a master or individual permit to a licensed renderer, collection center, or dead animal hauler for the purpose of authorizing transport of a dead animal to a permitted landfill when the renderer cannot process the dead animal due to operational conditions or legal or regulatory requirements or constraints.

Nonetheless, additional work is needed to improve the State's ability to respond to sub-emergencies. Permits for many of California's landfills do not allow acceptance of animal carcasses, particularly livestock and poultry carcasses. The jurisdictions hosting the few landfills that do have permits that allow the large animals are currently carrying the disposal burden for most other parts of the State. Hence some counties have tried to restrict acceptance to only their county because of the volume it generates. This has raised legal questions about whether or not the host jurisdictions have the authority to deny acceptance of material originating outside the jurisdiction and lead to a call for all jurisdictions with significant animal populations to identify and secure adequate disposal capacity for animal production activities.

Appendix A. Comparison of Carcass Disposal Options

Table 1 provides a general list of carcass disposal options with notes detailing their advantages and challenges.

Operational Considerations

Selecting the appropriate disposal method will be dependent on a multitude of situational factors including but not limited to: type of disease, type of animal, location, number of mortalities, decontamination challenges, transportation requirements, regulatory approvals, public relations issues, and cost.

Experimental/Novel Methods

There are several experimental or novel methods for carcass disposal, they include but are not limited to the following:

- Thermal depolymerization;
- Plasma arc process;
- Refeeding;
- Napalm;
- Ocean disposal;
- Non-traditional rendering (including flash dehydration, fluidized-bed drying, and extrusion/expeller press); and,
- Novel pyrolysis technology.

References. Key references regarding carcass disposal are as follows:

Emergency Animal Disease Removal Workgroup. 2004. CAL/EPA Emergency Animal Disease: Regulatory Guidance for Disposal and Decontamination. Developed for the Interagency Foreign Animal Disease Workgroup, by the Emergency Animal Disease Removal Workgroup, and Emergency Response Management Committee. 35 pp.

National Agricultural Biosecurity Center Consortium Carcass Disposal Workgroup. 2004. Carcass Disposal: A Comprehensive Review. Report prepared by the National Agricultural Biosecurity Center Consortium Carcass Disposal Workgroup for the For the USDA Animal & Plant Health Inspection Service Per Cooperative Agreement 02-1001-0355-CA. 689 pp.

Type		Advantages	Challenges
Rendering		• Mitigates environmental Impacts • Safe, usable, valuable output • Cost competitive • Reduces emissions of greenhouse gasses	• Transportation • Capacity • Storage of carcasses • Disposal of material that cannot be rendered • Urban encroachment
Burial	Trench	• Cheap • Equipment readily available	• Water quality impacts • Site security • Disease agent survival • Long-term management •
	Mass	• Equipment readily available • Advanced planning possible	• Cost • Significant water quality impacts • Site security • Disease agent survival • Transportation • Long-term management • Potential public opposition •
	Landfill	• Already exist • Advance planning possible • Controlled environment	• Cost • Permit doesn't allow operator's discretion • Possible public health risk • Transportation • Long-term management •

Type		Advantages	Challenges
Incineration	Open-Air Burning ("pyres")	• Relatively cheap • Reduction of volume • Destruction of most pathogens • Mitigation of water quality impacts	• TSEs not completely destroyed • Significant air quality impact • Labor requirements • Fuel requirements • Probable public opposition
	Air Curtain Destructor	• Reduction of volume • Destruction of pathogens, including TSEs • Mitigation of water quality impacts • Cost not prohibitive • Reduces air quality Impacts	• Suitable for TSEs • Labor requirements • Fuel requirements • Possible public opposition if not properly managed • Trained operators
	Fixed Facility	• Reduction of volume • Destruction of pathogens • Mitigation of water quality impacts • Existing facilities • Reduces air quality Impacts	• Cost • Limited or no capacity in California • Transportation
	Biological (high temp. and pressure)	• Reduction of volume • Mitigation of water quality impacts • Existing facilities	• Cost • Carcasses poor quality input • Existence in California?

Type		Positives	Challenges
Composting	*Composting of mammalian tissue is not currently permitted under California law.*	• Feasible on Small Scale • Reduction in water content • Land application of output? • Compatible with many poultry operations • "Scaleable" in emergency • Keeps potentially infected carcasses contained on-site • Requires no additional investment in an emergency	• TSEs not completely destroyed • Challenging on large scale • Water quality impacts • Public nuisance (e.g. odor, vermin) • Time to maturity • Land requirements • Site security • Long-term management • Requires infrastructure investment for routine use (concrete pad, etc.)
Lactic Acid Fermentation		• Simple • Decontamination of carcasses • Possibility of recycling into a feedstuff • Possibility of storage • Potentially mobile process	• All pathogens are not destroyed • Risk of contamination • Problem of corrosion • Need carbohydrate source and culture of *Lactobacillus acidophilus* • Transportation • Commercial availability
Alkaline Hydrolysis		• Will inactivate TSE • Destruction of pathogens • Reduction of volume	• Capacity • Effluent disposal • Transportation • Not commercially available • High cost

Type		Positives	Challenges
Anaerobic Digestion	Technical	• Couples the treatment of waste and production of energy • Reduction of odors • Suited for large-scale operations • Methane is used in place of fossil fuels • Reduces pollution by greenhouse gases by combusting methane • Recycle effluent in fertilizer • Reduces chemical and biological oxygen demand, total • solids and volatile solids of the carcass • Destroys, or reduces to acceptable levels, coliform bacteria, pathogens, insect eggs and internal parasites	• Cost of construction is expensive • Sludge disposal is a problem in some locations • Larger than other installations such as lactic acid fermentation • Difficulty of storage of gas (corrosive) • Significant consumption of water • Storage of fertilizer is difficult • Problem of management of the sludge • Does not destroy all pathogens including Prions & thermo resistant bacteria (e.g., Bacillus cereus)

Table 1. Selected Carcass Disposal Options along with Advantages and Challenges of each. Summarized from the Emergency Animal Disease Removal Workgroup, 2004 and from the National Agricultural Biosecurity Center Consortium Carcass Disposal Workgroup, 2004.

Appendix B. A Primer on California Rendering Infrastructure

California rendering companies provide a critical public health and environmental infrastructure to the State by collecting, processing and recycling animal based materials from California's farmers, ranchers and processors and from butcher shops, grocery stores and restaurants. In fiscal year 2007/2008, close to 2.5 billion pounds of material were recycled that included but were not limited to:

- Animal Mortalities;
- Viscera/Offal;
- Bone;
- Meat and Meat trim;
- Fat trim;
- Blood;
- Feathers;
- Other meat byproducts;
- Processed and fresh meat after "sale by" date;
- Recycled cooking oil; and,
- Trap grease disposal.

The Rendering Process[15]

In general, rendering is a process of both physical and chemical transformation using a variety of equipment and steps. The rendering process always involves the application of heat, the extraction of moisture, and the separation of fat. A general schematic of the process is found in Figure 1. The key advantages of the rendering process include but are not limited to the following:

- **Infrastructure**
  - Demonstrated effectiveness
  - Plants can process more than 6 million pounds of feedstock per day
  - Most areas of California are serviced
  - Specialized equipment is utilized
  - Investment intensive
  - Use or disposal of end products and wastes can be controlled
  - Prevents access by susceptible animals
  - Biosecure collection of raw materials
  - Requires specialized fleet and protocols.

[15] Excerpted from Rendering: An Essential Service Industry. C. R. Hamilton. Darling International Inc. Irving, Texas. Presented to the California Emergency Carcass Disposal Working Group, October 10, 2007.

- **Volume reduction of high moisture raw materials**
  - Volume reduced > 60%
  - Finished products stable and biosecure.

- **Traceability – Verification - Accountability**
  - Highly regulated industry both by agricultural, public health and environmental agencies
  - Documentation to trace raw materials back to source and finished products forward to use (as required and enforced by the FDA).

- **Recycled products**
  - Protein: primarily used in animal feed
  - Fats: chemical industries and animal feed
  - Water: treated on site by dissolved air flotation (DAF) before discharge.

- **Timely processing – pathogens killed quickly**
  - Prevents pathogen from spreading
  - Reduces potential for insect/pest/scavenger vectors
  - Suitable for recycling or disposal.

- **Biosecurity.**
  - Pathogens killed by process temperatures of 240 to 295° F (115 to 146° C). Table 2 provides information in regards to kill of specific human pathogens.
  - Used to eradicate diseases, such as pseudorabies, circovirus, etc.
  - Most effective process to minimize human exposure to biological and chemical hazards.

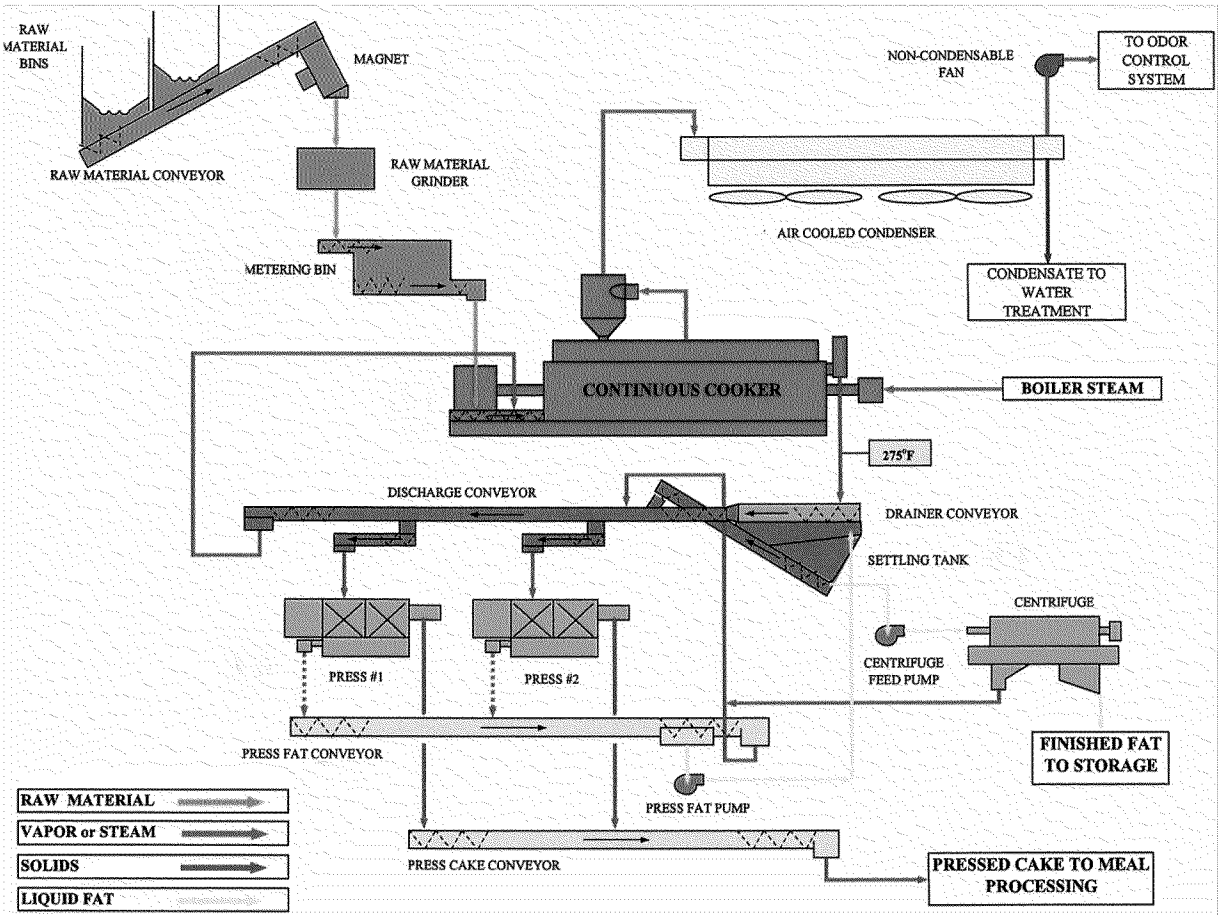


Figure A1. The rendering process. (Hamilton 2007).

Table A2. Efficacy of the U.S. Rendering System in the Destruction of Pathogenic Bacteria. Source: Troutt et al., 2001. Samples from 17 different rendering facilities taken during the winter and summer

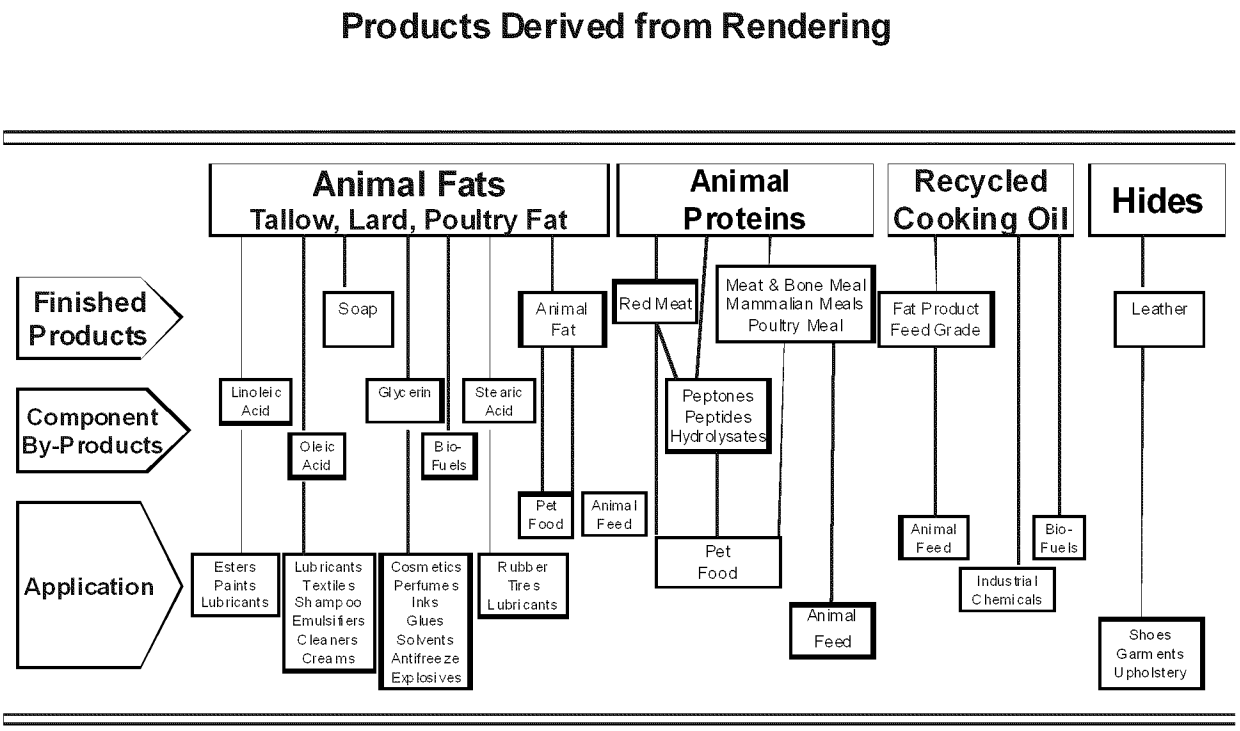
	Raw	Tissue
Pathogen	**% samples positive**	**% samples positive**
Clostridium perfringens	71.4	0
Listeria species	76.2	0
L. monocytogenes	8.3	0
Campylobacter species	29.8	0
C. jejuni	20.0	0
Salmonella species	84.5	0

Rendering - The Recycled Products[16]

[16] Excerpted from: Rendering: An Essential Service Industry. C. R. Hamilton. Darling International Inc. Irving, Texas. Presented to the California Emergency Carcass Disposal Working Group. October 10, 2007

The rendering process converts raw animal tissue into various protein, fat, and mineral products—rich granular-type meals and liquid fats with specific nutritional components. Figure 2 provides a summary of products derived from rendering.

Figure A2. Products Derived from Rendering. (Hamilton 2007)



Appendix C. Emergency Proclamations:
A quick reference guide for local government.

EMERGENCY PROCLAMATIONS

A quick reference guide for Local Government

Arnold Schwarzenegger, Governor
Henry R. Renteria, Director

General Information about Local Emergency Proclamations

Definition of Local Emergency: "The duly proclaimed existence of conditions of disaster or of extreme peril to the safety of persons and property within the territorial limits of a county, city and county, or city, caused by such conditions as air pollution, fire, flood, storm, epidemic, riot, drought, sudden and severe energy shortage, plant or animal infestation or disease, the Governor's warning of an earthquake or volcanic prediction, or an earthquake... or other conditions, other than conditions resulting from a labor controversy, which are or are likely to be beyond the control of the services, personnel, equipment, and facilities of that political subdivision and require the combined forces of other political subdivisions to combat..." *Section 8558(c), Chapter 7 of Division 1 of Title 2 of the Government Code*

Issued by:

- Governing body of city, county, or city and county, or
- An official designated by an adopted local ordinance (e.g., police/fire chief, director of emergency services)

Purpose:

- Authorizes the undertaking of extraordinary police powers
- Provides limited immunity for emergency actions of public employees and governing bodies
- Authorizes the issuance of orders and regulations to protect life and property (e.g., curfews)
- Activates pre-established local emergency provisions such as special purchasing and contracting
- Prerequisite for requesting a Governor's Proclamation of a State of Emergency and/or a Presidential Declaration of an Emergency or Major Disaster. *

Deadlines:

- **Issuance:** Within 10 days of the occurrence of a disaster if assistance will be requested through the California Disaster Assistance Act (CDAA).
- **Ratification:** If issued by official designated by ordinance, must be ratified by governing body within 7 days
- **Renewal:** Reviewed at regularly scheduled board/council meetings until terminated
    - Reviewed every 14 days for governing bodies that meet weekly until terminated
    - No review to exceed 21 days from last review
- **Termination:** When conditions warranting proclamation have ended

Notification Process:

- Local governments should notify the Operational Area (OA) and provide a copy of the local emergency proclamation as soon as possible
- OA shall notify their state OES Region and provide a copy of the proclamation as soon as possible
- OES Region will notify the OES Director and Deputy Directors; and shall be the primary contact between the OES Director, OA and the local jurisdiction for updates on any requests for assistance
- OES Director will respond in writing to the local government concerning the status of any requests for assistance included within the local proclamation or accompanying letter

Please Note: **A local emergency proclamation and/or Governor's Proclamation is not a prerequisite for mutual aid assistance, Red Cross assistance, the federal Fire Management Assistance Grant Program, or disaster loan programs designated by the Small Business Administration, or the U.S. Department of Agriculture.*

Levels of Disaster Assistance

Director's Concurrence:

Purpose: The CDAA authorizes the OES Director, at his discretion, to provide financial assistance to repair and restore damaged public facilities and infrastructure.
Deadline: State OES must receive request from local government within 10 days of incident.
Supporting Information Required: Local Emergency Proclamation, Initial Damage Estimate (IDE) prepared in the Response Information Management System (RIMS), and a request from the City Mayor or Administrative Officer, or County Board of Supervisors.

Governor's Proclamation:

Purpose: Provides Governor with powers authorized by the Emergency Services Act; authorizes OES Director to provide financial relief for emergency actions and restoration of public facilities and infrastructure; prerequisite when requesting federal declaration of a major disaster or emergency.
Deadline: State OES must receive request from local government within 10 days of incident.
Supporting Information Required: Local Emergency Proclamation, IDE prepared in RIMS, and a request from the City Mayor or Administrative Officer, or County Board of Supervisors.

Presidential Declaration of an Emergency:

Purpose: Supports response activities of the federal, state and local government. Authorizes federal agencies to provide "essential" assistance including debris removal, temporary housing and the distribution of medicine, food, and other consumable supplies.
Deadline: Governor must request on behalf of local government within 5 days after the need for federal emergency assistance is apparent.
Supporting Information Required: All of the supporting information required above and, a Governor's Proclamation, certification by the Governor that the effective response is beyond the capability of the state, confirmation that the Governor has executed the state's emergency plan, information describing the state and local efforts, identification of the specific type and extent of federal emergency assistance needed.

Presidential Declaration of a Major Disaster:

Purpose: Supports response and recovery activities of the federal, state, and local government and disaster relief organizations. Authorizes implementation of some or all federal recovery programs including public assistance, individual assistance and hazard mitigation.
Deadline: Governor must request federal declaration of a major disaster within 30 days of incident.
Supporting Information Required: All of the supporting information required above and, a Governor's Proclamation, certification by the Governor that the effective response is beyond the capability of the state, confirmation that the Governor has executed the state's emergency plan, and identification of the specific type and extent of federal aid required.

Federal/State Disaster Assistance that require a local emergency Proclamation

Local Government:

- ✓Reimbursement of extraordinary emergency costs (e.g., police overtime, debris removal, sandbagging)
- ✓Funds to repair damaged public facilities (e.g., buildings, roads, equipment, utilities)
- ✓Hazard Mitigation

Individuals and Families:

- ✓Housing assistance such as home repairs and temporary lodging/rental assistance
- ✓Personal property, medical/dental expenses
- ✓Disaster unemployment benefits
- ✓Crisis Counseling

SAMPLE PROCLAMATION

WHEREAS, Ordinance No. _____ of the *City/County* of _____ empowers the *Director of Emergency Services** to proclaim the existence or threatened existence of a local emergency when said *City/ County* is affected or likely to be affected by a public calamity and the City Council/County Board of Supervisors is not in session, and;

WHEREAS, the *Director of Emergency Services** of the *City/County* of _____does hereby find; That conditions of extreme peril to the safety of persons and property have arisen within said *city/county*, caused by _____*(fire, flood, storm, mudslides, torrential rain, wind, earthquake, drought, or other causes)*; which began on the _____th day of _____, 20_____. and;

That these conditions are or are likely to be beyond the control of the services, personnel, equipment, and facilities of said *City/County,* and;

That the City Council/County Board of Supervisors of the *City/County* of _____ is not in session and cannot immediately be called into session;

NOW, THEREFORE, IT IS HEREBY PROCLAIMED that a local emergency now exists throughout said *City/County*, and;

IT IS FURTHER PROCLAIMED AND ORDERED that during the existence of said local emergency the powers, functions, and duties of the emergency organization of this *City/County* shall be those prescribed by state law, by ordinances, and resolutions of this *City/County*, and; That this emergency proclamation shall expire in 7 days after issuance unless confirmed and ratified by the governing body of the *City/County* of _____ _____.

Dated: _____ By: _____

*Director of Emergency Services**

Print Name _____

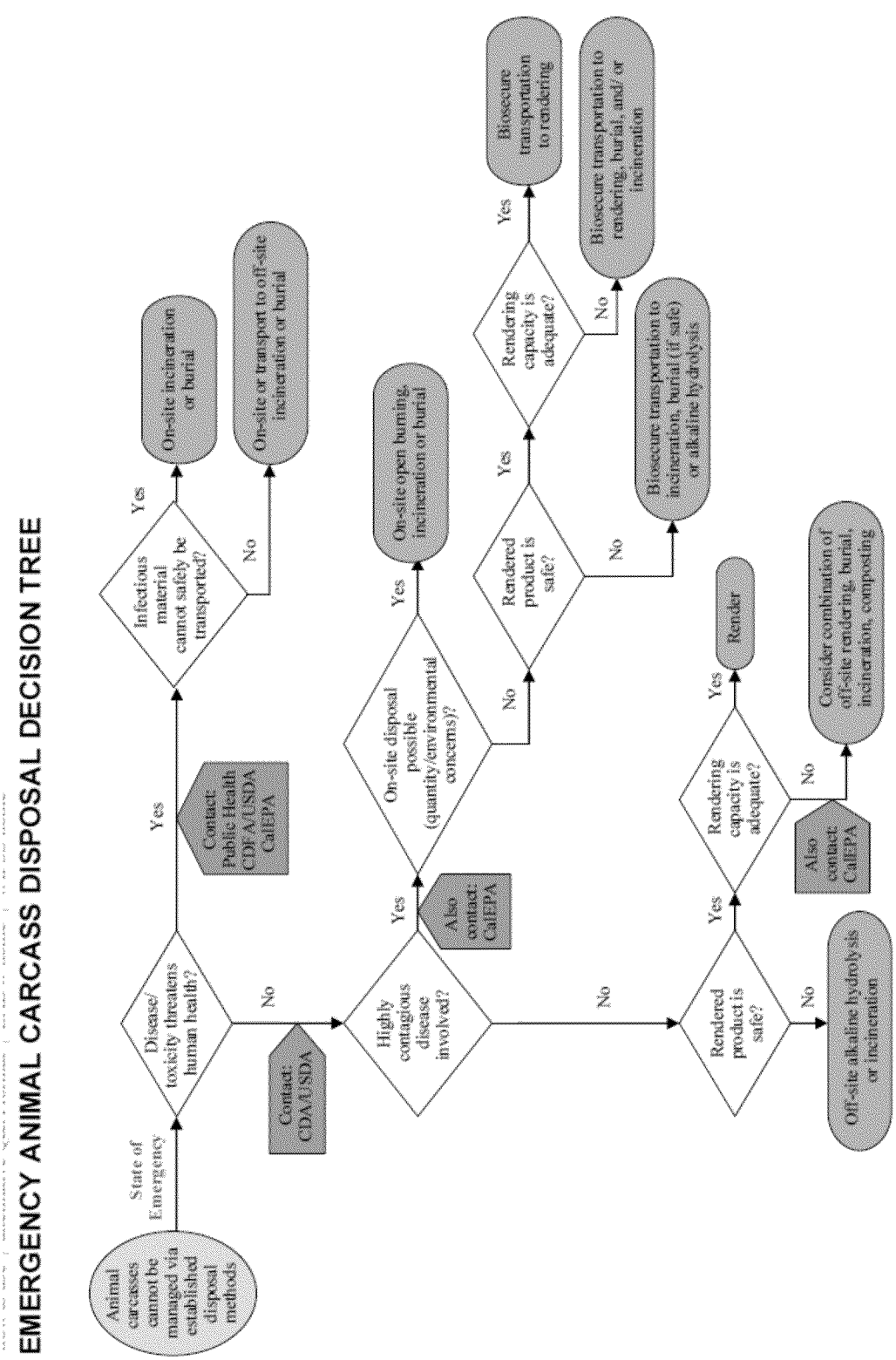
Address _____

**Insert appropriate title and governing body*

Note: *It may not be necessary for a city to proclaim a local emergency if the county has already proclaimed an emergency that applies to the entire geographic county area or for a specific area that includes the impacted city*

This guide is not intended to be a legal opinion on the emergency proclamation process and related programs under state law. Local governments should consult their own legal counsel when considering proclaiming a local state of emergency.

Appendix D. Disposal Option Decision Tree



Appendix E. List of Acronyms.

- BSE – Bovine Spongiform Encephalopathy
- Cal-EMA – California Emergency Management Agency
- Cal/EPA – California Environmental Protection Agency
- CCR – California Code of Regulations
- CDFA – California Department of Food and Agriculture
- CIWMB – California Integrated Waste Management Board (as of January 1, 2010, the CIWMB ceased to exist as an agency and became part of a new Department of Resources Recycling and Recovery (CalRecycle))
- EADW – Emergency Animal Disposal Workgroup
- FAC – Food and Agricultural Code
- LEA – Local Enforcement Agency
- OES – Governor's Office of Emergency Services
- PCRA – Pacific Coast Rendering Association
- RWB – Regional Water Quality Control Board
- SJV – San Joaquin Valley
- TSE – Transmissible Spongiform Encephalopathy
- USDA-VS – United States Department of Agriculture, Veterinary Services
- WIFSS – Western Institute of Food Safety and Security

Appendix F. Participants in the Emergency Animal Dispsoal Workgroup (EADW).

Livestock Industry
Alliance of Western Milk Producers
CA Cattlemen's Association
CA Dairies Inc.
CA Dairy Campaign
CA Farm Bureau Federation
CA Poultry Federation
CA Pork Producers Association
CA Wool Growers Association
Foster Farms
Harris Ranch Beef Company
Milk Producers Council
National Meat Association
Pacific Egg and Poultry Association
Western United Dairymen

Industry Allied to Livestock Production
Baker Commodities, Inc.
California Grain and Feed Association
CalRecovry Inc.
Darling International, Inc.
George Larson & Associates
Integrated Waste Management Consulting
National Renderers Association
North State Rendering
Sacramento Rendering
Waste Management
West Coast Rendering

State & Federal Regulatory Agencies
CA Air Resources Board
CA Department of Food and Agriculture
CA Department of Public Health
CA Depart. Resources Recycling Recovery
CA Department of Transportation
CA State Water Resources Control Board
Center for Veterinary Medicine, FDA
Governors' Office of Emergency Services
US Department of Agriculture
(APHIS, NRCS)

Local Regulatory Agencies
Central Valley Regional Water Quality Control Board
County Env. Health / Public Works / Emerg. Services / Waste Management
(Fresno, Kern, Kings, Merced, Stanislaus)
County Ag Commissioners
(Fresno, Kings, Stanislaus, Tulare)
San Joaquin Valley Unified Air Pollution Control District

Academic Organizations
California Animal Health & Food Safety Lab
California Dairy Quality Assurance Program
California Polytechnic State University
UC Davis School of Veterinary Medicine
UC Davis, Animal Science
UC Davis, Biological and Agricultural Engineering
UC Davis, Plant Pathology
UC Riverside Department of Environmental Science
UC Cooperative Extension
(Kings, Merced, Riverside, San Bernardino, San Joaquin, Tulare)
Western Institute for Food Safety and Security